LESSON 2

LET'S TALK ABOUT ... HEAT

STUDENT' WORKSHEET

Names:		Surnames:		Group: 3rd ESO __	Qualification
				Date:	

LET'S TALK ABOUT HEAT

Heat is a word that we usually use. When an object has a high temperature we say the object is **hot**. We have use heat for many years. Prehistoric men use the heat produced by fire, to obtain a more comfortable life. We need heat to boil water or when we are cold.

But…**What heat is?**

In this unit, we are going to learn lot of things about heat. To start with, you have to do an activity to know your previous knowledge related to HEAT. Let's go!!!

INFORMATION ABOUT ACTIVITIES:

Individual activity

Work in pairs

Work in groups of three

Work in groups of four

PREVIOUS ACTIVITY (SELF-ASSESSMENT ACTIVITY)

Previous activity To know your previous knowledge, choose the best answer for these questions (some questions (indicated) can have more than one possible answer, in this case, choose all the possible answers. If not indicated, and there are more than one correct answer, choose the best one). At the end of the activity you will find the correct answers. Each correct answer: 1 point. If you don't find the answers, don't worry, it's just to know your previous knowledge.

1. If we put a thermometer in two different objects, and in the object A the thermometer shows 100ºC and in the object B 50ºC, which one is the hottest object?
   a) Object A.
   b) Object B.
   c) Both have the same heat.
   d) All the answers are wrong.

2. If two similar objects that have a different temperature (T_A = 100ºC and T_B = 50ºC) are putted in contact; what does it happen?
   a) Nothing.
   b) The object with T= 50ºC increases its temperature and the object with T=100ºC decreases its temperature until they achieve the same temperature.
   c) The object with T=50ºC increases its temperature until it achieves T=100ºC.
   d) The object with T=100ºC absorbs heat from the object with T=50ºC.

3. What of the next units represents a heat unit?
   a) Kelvin.
   b) Celsius.
   c) Calories.
   d) Fahrenheit.

4. Some units used to measure heat are: (***more than one possible answer***)
    a) Joule.
    b) Newton.
    c) Watt.
    d) Calorie.

5. According to your previous knowledge, what do you think heat is?
    a) A type of force.
    b) A type of power.
    c) A type of energy.
    d) A type of thermometer.

6. 0º Celsius degrees are similar to …
    a) 212 Fahrenheit degrees.
    b) 0 Fahrenheit degrees.
    c) 32 Fahrenheit degrees.
    d) 100 Fahrenheit degrees.

7. 212 F are the same that:
    a) 0ºC.
    b) 100ºC
    c) 32ºC.
    d) 50ºC.

8. 373 K are the same that:
    a) 0ºC.
    b) 100ºC.
    c) 32ºC.
    d) 50ºC.

9. If we put in contact two objects with a different temperature:
    a) Heat flows from the object that has a higher temperature to the other that has a lower temperature, until they achieve the same temperature.
    b) Heat flows from the object that has a lower temperature to the other that has a higher temperature, until they achieve the same temperature.
    c) The object with a higher temperature increases its heat.
    d) Nothing happens.

10. When we bring our hands to a car engine after travel 200 km; what we could feel?

    Why do you think so?

11. In which of the next situations we need heat? (***more than one possible answer***)
    a) To obtain hot water.
    b) To watch TV.
    c) To play sport.
    d) To obtain petrol from the oil by the distillation process.
    e) To cook.
    f) In cold winter days, to stay comfortable at home.
    g) A stone is lying on the Earth' surface.
    h) To produce the water cycle.
    i) To obtain coffee by using a coffee maker.
    j) To listen music.

12. The boiling point temperature in normal conditions is:
    a) 0ºC.
    b) 100ºC.
    c) 50ºC.
    d) 190ºC.

13. The freezing point temperature in normal conditions is:
    a) 0ºC.
    b) 100ºC.
    c) 50ºC.
    d) 190ºC.

14. The heat transmission due to the Sun is produced by:
    a) Conduction.
    b) Convection.
    c) Radiation.
    d) Hyper ventilation.

15. The heat transmission produced by two solid objects putted in contact is:
    a) Conduction.
    b) Convection.
    c) Radiation.
    d) Hyper ventilation.

16. The heat transmission that appears in next picture is called:
    a) Conduction.
    b) Convection.
    c) Radiation.
    d) Hyper ventilation.

17. A combustion reaction produces heat, so, is an:
    a) Exothermic reaction.
    b) Endothermic reaction.
    c) Alternative reaction.
    d) Impossible reaction.

CORRECT ANSWERS (each correct answer 1 point; some have more than one point. Maximum 25 points):

1: **a** (The temperature is a measured of how hot an object is. More temperature means more heat).

2: **b** (When we put two objects with a different temperature in contact, both will achieve the same temperature. The object with higher temperature gives heat to the other, until they achieve the same temperature).

3: **c** (Calories, because Celsius, Fahrenheit and Kelvin are temperature scales not a heat unit).

4: (**2 points. 1 point each correct answer**) (**a** and **d.** Newton measure force, and watt the power).

5: **c** (Heat is a type of energy)

6: **c** (0ºC are the same that 32 F)

7: **b** (212 F are the same that 100ºC)

8: **b** (373 K are the same that 100ºC)

9: **a** (Heat flows from the object with higher temperature to the object with lower temperature until they achieve the same temperature)

10: (**2 points, 1 point each correct answer**) **1. We feel that the engine' car is hot. 2. Because during the travel, the engine' car emits heat)**

11: (**7 Points, 1 point each correct answer**) **a, c, d, e, f, h, i.**

12: **b** (In normal conditions, the boiling water temperature is 100ºC).

13: **a** (In normal conditions, the freezing water temperature is 0ºC).

14: **c** (Radiation is the heat transmission produced in distances (no objects in contact)).

15: **a** (Conduction is the heat transmission produced when two solid objects are putted in contact).

16: **b** (This type of heat transmission in which the heat is transmitted by loops, (that appear in fluids (gases and some liquids)) are called convection).

17: **a** (An exothermic reaction gives heat).

FINAL SCORE (SELF ASSESSMENT PREVIOUS KNOLEDGE)

			
Less than 5 correct answers	6-11 correct answers	12-19 correct answers	20-25 correct answers
COUL BE BETTER	**SATISFACTORY**	**GOOD**	**YOU ARE A HEAT EXPERT**

Activity 1 (6 Points; 2 points each correct answer) According to the text, write the definition of the next words, you can do the same as the example:

Heat

Heat is a form of energy. When we have to places with different temperatures, energy flows from the hotter one to the colder, until they reach the same temperature. While a substance absorbs heat, its **internal energy** increases (Its internal molecules vibrate more). We call **heat** this kind of energy, and **temperature** is a measure of how hot something is.

As heat is a type of energy it's measured in **joules** (International system (S.I.)). However heat usually is expressed in **calories**. We define the calorie as the energy we need to increase 1°C the temperature of 1 gram of water. It takes 4.18 Joule to raise the temperature of 1g of pure water by just 1°C, so 1 calorie = 4.18 Joules (or 1 J = 0.24 cal.). Calorie was introduced by the French Nicolas Clément in XIX century.

To pass from one unit to the other, we can follow the next conversion factor (1 Kcal = 1000 calorie and 1 KJ = 1000 Joules):

$$1000\ J = \frac{1\ cal}{4.18\ J} = 239.24\ cal \quad \text{or} \quad 1000\ cal = \frac{4.18\ J}{1\ cal} = 4180\ J$$

Most substances expand when they are heated because their particles vibrate more vigorously, producing push between them.

The **temperature** of a body is the measure of the amount of heat content possessed by it. The **thermometer** is an instrument for measuring temperature. It may contain a liquid that expends when heated, or a wire whose resistance to electric current changes if the temperature changes.

Definitions:

Example: ***Heat: is a form of energy that flows from one place to another because of a difference in temperature.***

Temperature:

Calorie:

Thermometer:

Activity 2 (8 Points; 2 points each correct answer) Express the heat quantities in the required unit:

- Express 4180 Joules in calories: ……
- Express 1500 calories in Joules: ……
- Express 2.5 KJ in calories: ……..
- Express 3.5 Kcal in Joules: ……

Activity 3 (5 Points) Read next text and underline with a blue pen **all the information** about the Celsius scale temperature, with a **black** pen **all the information** about the Fahrenheit scale temperature and with a red pen **all the information** about the Kelvin scale temperature. (Alternatively, you can copy the three temperature scales, the equations and some examples in a piece of paper)

Temperature scales

Temperature can be measured in Celsius degrees (°C, temperature scale defined by the **Swedish** Anders Celsius in 1742), Fahrenheit degrees (°F, temperature scale defined by the **Polish** Daniel Gabriel Fahrenheit in 1724), or on the absolute temperature scale Kelvin (K, temperature scale defined by the **British** William Thomson in 1848). The **Celsius scale** has two fixed points: ice point (0°C) and steam point (100°C). Each Celsius degree is one hundredth of the difference between these two points. In the **Fahrenheit scale,** the values 32 °F and 212 °F are given to the ice and steam points. There are 180 degrees between them, so 1°C is different that 1°F. The **absolute temperature scale** is measured in units called Kelvin (K), which are the same size as degrees Celsius. The scale starts at a point called absolute zero (zero K) which is the same as - 273°C. This is the temperature at which no more energy can be removed from a substance.

To obtain a temperature expressed by the Celsius scale from a temperature expressed by a Fahrenheit scale, we have to use next expression:

$$T(^{o}C) = \frac{5}{9} \bullet (T(F) - 32) \quad ; \quad T(F) = \frac{9}{5} \cdot T(^{\circ}C) + 32$$

And to obtain a temperature expressed by the Kelvin sale from a temperature expressed by the Celsius scale, we have to use next expression:

$$T(K) = T(^{o}C) + 273 \quad ; \quad T(^{\circ}C) = T(K) - 273$$

Examples:

125 F are the same than 51.7 °C

T (°C) = $\frac{5}{9} \cdot (125 - 32) = 51.7^{o}C$

50 °C are the same than 147.6 °F

T (°F) = $\frac{9}{5} \cdot (50 + 32) = \ 147.6\ ^{o}F$

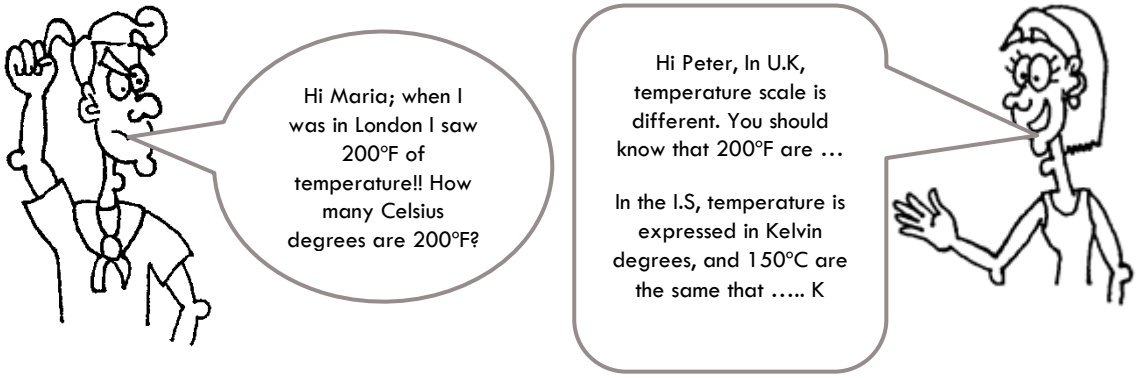
85 °C are the same than 358 K

T (K) = 85 + 273 = 358 K

310 K is the same than 37 °C

T (°C) = 310 – 273 = 37 °C

Activity 4 (4 Points; 2 points each correct answer)



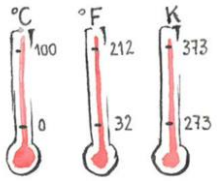
Help Peter and Maria to find next temperatures:

a) 200 ºF pass to the Celsius scale temperature: 200 ºF are the same than _____ ºC.

b) 150 ºC pass to the Kelvin scale temperature: 150 ºC are the same than _____ K.

Activity 5 (7 Points)

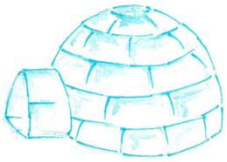
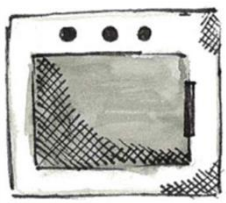
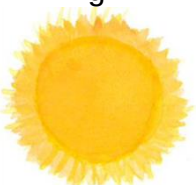
Remember the most common temperature scales (Celsius, Fahrenheit and Kelvin) and match them with the columns of the pictures bellow. Maybe you can find more than one possibility. (**HELP: Express all the temperatures in the Celsius scale**). *Follow the example number **3**: $T\,(ºC) = \frac{5}{9} \cdot (212 - 32) = 100\ ºC$ Correct answer letter **a**: so **3→a.***



Temperatures

1) 32 ºF	2) - 20ºC	3) **212 ºF**	4) 80 ºF	5) 11000 º F	6) 130 F	7) 373 K	8) 310 F

Pictures

a. 	b. 	**c.** FREEZING POINT	d. 
e. 	f. 	g. 	h. BOILING WATER TEMPERATURE

Correct answers:

1) 2) 3) **a** 4) 5) 6) 7) 8)

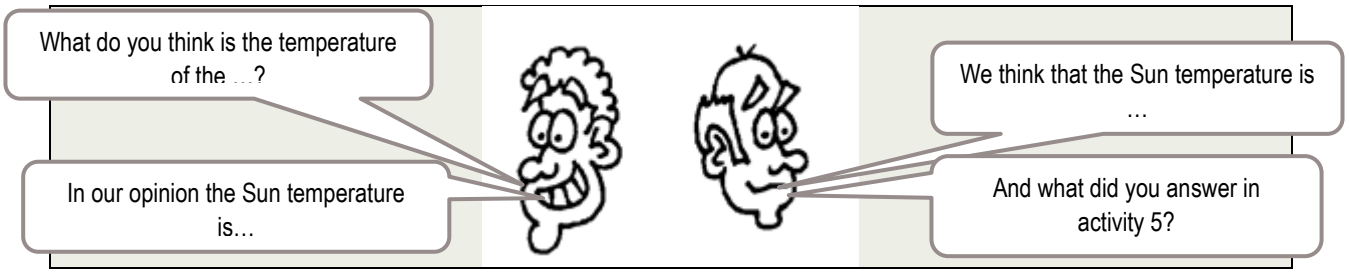
Activity 6 (3 Points) Compare the answers given by you, with the answers given by your nearest classmates. You can use some expressions like the example: (*you have to write **three** sentences*)

HELP: HOW TO GIVE OPINIONS?

GIVING OPINIONS TO COMPARE ANSWERS

What do you think about…?
What is your opinion about …?
Why do/does/did …?
What are your answers in ….?
In my opinion …
From my point of view …
I think …
I answered ….
I think so.
I don't think so.
I agree.
I don't agree. I disagree.
Give me a reason for that.

.



Example:

The nearest classmates thins that the Sun temperature is _____.

1.

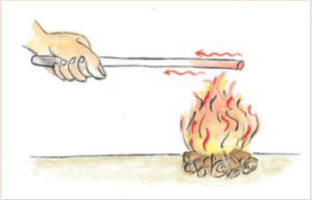
2.

3.

Optional: watch the video "heat transfer" in: https://www.youtube.com/watch?v=FTSBtx5jhaY or/and the video https://www.youtube.com/watch?v=zvQZtpZnRRE

Heat transfer

Heat energy can be transferred from one body to the other or from one location in a body to the other. The way used to transfer heat energy is known as "**heat transfer**". To produce this heat transfer between two bodies there needs to be a different temperature between them. This heat transfer can be produced through three different processes called **conduction, convection** and **radiation.**



CONDUCTION

CONVECTION

RADIATION

Activity 7 (3 Points) According to the next words and pictures, write the correct word in the **gaps** (the titles have a gap) of the **next text**, like the example. You have to write convection, conduction or radiation: (*words appear more than one time*)

Words:

Convection	**Conduction**	**Radiation**

Text

Heat transfer in our life

Heat can be transferred from one place to another by **convection**, **conduction** or **radiation**.

Convection

Convection is the main way in which heat energy is transferred in liquids and gases. When a liquid or gas is heated, the part nearest the heat source expands and becomes less dense, so it rises (go up). The cooler, denser liquid is forced to go down. This type of heat transmission is called _____ (1).

Conduction

_____ (2) is the way in which heat energy in a solid form is transferred. The energy of the particles nearest to the heat source increases. These particles vibrate faster and pass their energy to the nearest particles. Examples of good **conductors** are "metals", because they contain freely moving electrons, making easy and fast the energy transmission between particles. Other substances, such as wood and water, are called **insulators** because they conduct heat slowly. Air is a good insulator and so, materials that trap air such as wool, fur and feathers, are insulators as well.

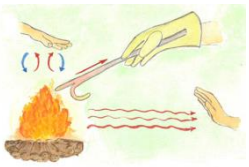
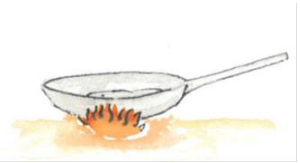
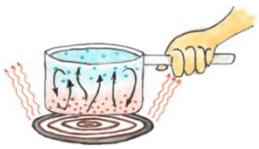
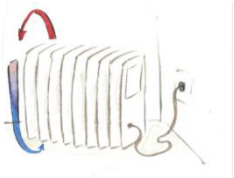
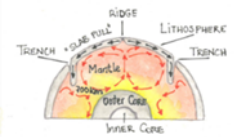
Radiation

This type of heat transmission is in a remote way (substances are not putted in contact). Heat transferred by radiation is done by the form of electromagnetic waves. When an object has a temperature, the object emit a radiation (visible or not) in the form of electromagnetic waves. To transmit heat through _____ (3) it's not required a medium to convey the energy. The Energy produced by the Sun is an example of radiation.

Activity 8 (17 Points) Classify the following pictures in the columns bellow. Maybe you can find one picture that can be put in more than one column, in this case, put the picture in all the columns where the picture can be put. Follow the example:

		
1,	**1**,	**1,**

Pictures:

1. 	2. 	3. 	4. 
5. 	6. 	7. 	8. 
9. 	10. 	11. 	12.  Magma (Earth)

How can we obtain heat? Energy conversion

The law of conservation of energy states that energy can never be created or destroyed. Whenever anything happens, energy is converted into a different form. This is what happens, for example, when plants use energy from sunlight to make food, and when animals eat them in turn.

Heat can be obtained directly or by transforming one type of energy into heat. For example, the Sun heats our planet (directly) or with natural gas we can obtain heat used to cook. One very used way to obtain heat is by the combustion reaction. In a combustion reaction, a substance (hydrocarbon) reacts with oxygen from the air producing heat and other substances.

Organic Molecules with (C,H and O) + $O_2 \longrightarrow CO_2 + H_2O$ + **Heat**

Ideal combustion reaction

Combustion reaction converts the chemical energy stored in some substances into heat. In fact, in the most of the energy conversions (one type of energy is transformed in another one), heat is produced. For example, in a car engine, the chemical energy stored in the fossil fuels used in them (petrol, diesel or butane), with combustion reaction are transformed into heat.

Some examples of hydrocarbons are fossil fuels (coal, oil and natural gas) or wood. Other substances can be combusted, as for example the municipal solid waste, or anything you can burn.

The heat obtained directly or by combustion can be used to cook, to light, to heat homes, to power cars, etc.

To obtain heat, in lots of processes, it's normal to use fossil fuels. Lots of Europeans countries don't have fossil fuels and they have to buy it. More and more, the fossil fuel combustion produces some polluted gases that cause problems in our environment. For these reasons the European Union promotes replace fossil fuels for renewable energy resources.

Activity 9 (5 Points) Write 5 different ways used to obtain heat. Follow the example:

Example: We can obtain heat by burning wood.

1.

2.

3.

4.

5.

Activity 10 (10 Points) Help Omero and put a cross (X) if next situations are a use of heat:

1. I need to obtain boiled water.	
2. I use a sandwich maker.	
3. I use sunglasses.	
4. I want to eat pizza and so, I put the pizza into the oven.	
5. I want to cook a fried egg.	
6. A stone is lying on the floor.	
7. A branch is floating on a river.	
8. I want to take a shower with hot water.	
9. I burnt wood in a chimney.	
10. I read a book.	

Activity 11 (5 Points) Why do you think that when I bring my hands near a thermic car engine (motor) I feel my hands hot? (***HELP: Read text "How can we obtain heat? Energy conversion")***

HELP: RELATION CAUSE-EFFECT. GIVING REASONS

therefore
as a result
because/thanks to
consequently/so
for example
for instance
so
that is why
thus
such as

I think that I feel my hands hot when I bring them to a thermic car engine because ……..

……..

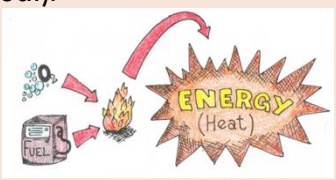
Optional: watch the video "Endothermic and exothermic reactions or processes" in:
https://www.youtube.com/watch?v=dID0pJTmjME

Endothermic and exothermic reactions or processes

When some reactions or processes take place, sometimes appears heat in the process. An **exothermic** reaction or process releases energy (heat, light or sound, (most of the time as heat)), when it is produced, rising the surroundings temperature. An **endothermic** reaction or process absorbs heat (energy) in order to proceed, cooling the surroundings.

One example of an **exothermic reaction** is combustion reaction. In this reaction is released energy (usually heat):

Organic Molecules with (C,H and O) + O_2 ⟶ CO_2 + H_2O + Heat



One example of an **endothermic process** is the melting ice. In this reaction is needed heat to be produced:

ICE + HEAT ⟹ WATER (liquid)

Activity 12 (19 Points) Put a cross in next reactions or processes according if they are **endothermic** or **exothermic**. (HELP read the previous text ("***Endothermic and exothermic reactions or processes***")). (*If you need more information you can search on the net*). Follow the example:

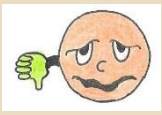
Example:

	Exothermic	Endothermic
Combustion reaction	X	
Melting ice.		X

	Exothermic	Endothermic
1. Photosynthesis.		
2. CO_2 formation from carbon and oxygen: $C + O_2 \rightarrow CO_2$ + Energy		
3. Iron oxidation: $2\ Fe + O_2 \rightarrow 2\ FeO$ + Energy		
4. Evaporation (Pass from liquid state to gas state)		
5. Breakdown of proteins due to the heat action.		
6. Solidification (Pass from liquid state to solid state)		
7. Butane reaction with oxygen (combustion reaction)		
8. CO_2 decomposition to obtain carbon and oxygen.		
9. Melting (Pass from solid state to liquid state)		
10. The breathing of living beings.		
11. Water molecules formation: $2\ H_2 + O_2 \rightarrow 2\ H_2O$ + Energy		
12. Ozone production in the atmosphere: $3\ O_2$ + Energy $\rightarrow 2\ O_3$		
13. Condensation (Pass from gas state to liquid state)		
14. Ammonia formation: $N_2 + 3\ H_2O \rightarrow 2\ NH_3$ + Energy		
15. Water electrolysis.		
16. Dehydration of sugar with concentrated sulphuric acid. (Video)		
17. Frying of an egg on a pan. (Video)		
18. Reaction of vinegar and baking soda. (Video)		
19. Drying of clothes.		

Peer' assessment. Assess pair activities. Your name: _____ Group:

Put a tick in the right columns in the grid below, and assess your partner's work:

YOUR PARTNER'S NAME:	What to evaluate:	 COULD BE BETTER 1	 SATISFACTORY 2	 GOOD 3	 VERY GOOD 4
	Help doing the activities				
	Respects your solutions				
	English level (oral)				
	Follows instructions				
	Adds different ideas				
	Makes/answers questions				
	Proposes solutions				
TOTAL					**/28**

Self-assessment Assess yourself:

About the scenario:

1. Make a cross in the table below, according to the things you have learned in this scenario:

What to evaluate	 Could be better 1	 Satisfactory 2	 Good 3	 Very good 4
I learned some vocabulary related to heat.				
I know the main heat units.				
I can pass from one heat unit to another (the two more used heat units; cal., Joule)				
I can describe different heat transfers.				
I can calculate temperature in the three more used temperature scales (ºC, ºF, K)				
I can describe situations in which we need the use of heat.				
I'm able to give reasons, expressing my opinion.				
I can describe an exothermic and endothermic reaction or process.				
I enjoy working in groups.				
I can identify the heat transfer in different situations.				
TOTAL				**/40**

2. Write your mark with a cross (a number between 1 and 10).

1	2	3	4	5	6	7	8	9	10

3. What have you learned from this scenario?
4. What was easy for you?
5. What did you find difficult?
6. What would you find most helpful?
7. What did you like doing most?
8. What did you like doing least?
9. Write the most important words (key words) learned in this scenario.
10. Any suggestions?

In this scenario you have…

- Used English as a way to communicate.
- Worked in pairs, respecting and analysing critically the decisions made by your partners.
- Learnt some vocabulary related to heat.
- Used the two most important heat units.
- Identified different temperature scales.
- Expressed temperature in different temperature scales.
- Identified the different heat transfers.
- Identified endothermic and exothermic reactions or processes.
- Used internet to improve your knowledge.
- Learnt how to write a definition in English.
- Learnt how to compare in English.
- Learnt how to give opinions in English.